APPENDIX C

Affidavit of Philip C Malte Under Rule 132

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	GARDNER, Conrad O.	Group Art Unit:	3611
Application No.:	08/896,514	Examiner:	Michael Mar
Filing Date:	June 23, 1997	Docket No.:	95-004M
		Date:	December 9, 1999

For: EXTENDED RANGE MOTOR VEHICLE HAVING AMBIENT POLLUTANT PROCESSING

AFFIDAVIT OF PHILIP C. MALTE UNDER RULE 132

Philip C. Malte, being duly sworn, deposes and states:

1. Philip C. Malte is Professor of Mechanical Engineering at the University of Washington, Seattle, Washington. This position has been held since 1983. In the 10 -year period prior to 1983, Philip C. Malte was Assistant Professor of Mechanical Engineering at Washington State University, Pullman, Washington, Associate Professor of Mechanical Engineering at Washington State University, and Associate Professor of Mechanical Engineering at the University of Washington. Additional positions held include Engineer (Martin Marietta Corporation), Senior Engineer (Rohr Industries), Senior Engineer and Chief Consulting Engineer (Energy International, Inc), and US Department of Energy (Faculty Rotator).

2. Philip C. Malte studied engineering at The University of Michigan, Ann Arbor, Michigan. The degrees received include PhD in 1971, Masters of Science in 1966, and Bachelor of Science in 1964.

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3. Philip C. Malte has performed research and published in the field of Combustion since 1970. Focus of the research has been on the generation and control of pollutants in combustion systems, especially in gas turbine engines and piston engines.

4. Philip C. Malte has taught university courses on combustion engines and on combustion science and technology for approximately 25 years. The University of Washington course numbers are ME481 and ME424. Other courses taught deal with energy conversion.

5. Philip C. Malte has developed and maintained laboratories that support research and teaching on combustion and combustion engines. The Internal Combustion Engines Laboratory at the University of Washington includes dynamometer test stands with engines, including a multi-cylinder gasoline engine, a single-cylinder spark ignition engine, and two single-cylinder diesel engines.

6. Teaching on engines by Philip C. Malte has included traditional spark ignition and diesel engines, improvements in combustion for these engines, and alternatives to these engines. The latter topic includes hybrid-electric engines. Research on engines has dealt with combustion for land-based gas turbine engines and large-bore spark ignition engines, and alternative fuels for these engines.

7. Philip C. Malte is a Member of the American Society of Mechanical Engineers (ASME), The Combustion Institute (CI), and the Society of Automotive Engineering (SAE).

8. Publication by Philip C. Malte has occurred in the journals and proceedings of the ASME and the CI. Additionally, SAE papers have been written.

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9. Familiarity with hybrid-electric propulsion for automobiles has been gained by Philip C. Malte through teaching and study of the subject.

10. Philip C. Malte keeps abreast of the state of the art in combustion engines and related fields.

11. The Examiner has stated that:

The definitions of the systems in claims 34, 35, 37, 40 & 50-54 are unpatentable over Ellers.

Ellers discloses a pre-programmed control 25 which activates the internal combustion engine 21 and the electric torque converter 35 for coupling the engine to the second pair of wheels 15 and 17 when the vehicle approaches a pre-selected desirable speed of 55 mph. Since Ellers describes the pre-selected desirable speed at which the engine is activated as a cruising speed (col. 1, lines 55-58), after this speed has been reached, the vehicle is in a condition which constitutes a "cruise mode on condition". When the speed drops below 55 mph, the control decouples the engine from the second pair of wheels. This condition constitutes a "cruise mode off condition". The control could also activate a second coupling 65 for connecting the engine to an electric generator 63 for charging a battery 5 during the "cruise mode off condition". The internal combustion engine 21, being a small engine with no throttle control, would operate at a constant speed for maximum efficiency and minimum pollution. With respect to claims 42-44, note the control system for using only the electric motor at speeds below the pre-selected desirable speed of 55 mph. As the vehicle approaches the pre-selected desirable speed, the control system activates the internal combustion engine and disconnects electric power to the electric motor. Since the electric motor is always operating below the pre-selected desirable speed, the speedometer 67 would function as a display device for indicating when the electric motor is powering the hybrid vehicle at the lower speeds. With respect to claims 37 and 40, the engine drives the wheels when the vehicle is above the pre-selected desirable speed. When the battery charge is

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low, the control switches to a second mode in which power from the engine is transferred to the generator.

It would have been obvious to program the control circuit of Ellers to always connect the engine to the generator during the cruise mode off condition in order to maintain a fully charged battery. With respect to claim 50, since the cruise mode is set only when the vehicle has reached a predetermined speed, it would have been obvious to activate the cruise mode only after a predetermined period of time in which rapidly shifting power and speed demands have not occurred in order to provide a consistent speed for the cruise mode. With respect to claim 51, since Ellers teaches using the engine to drive the generator whenever the charged state of the battery is too low, it would have been obvious to activate the engine for charging the battery, even during periods of low speed when the electric motor is used to power the vehicle.

12. Regarding claims 34, 35, 37, 40, and 50-54, Philip C. Malte states:

Reading of Ellers (#4,923,025) strongly suggests the Internal Combustion Engine (ICE) does not come into play (i.e., does not drive a set of wheels) until the vehicle has reached a desirable highway cruising speed, such as 55 mph. At this point, the electric drive of a set of wheels is shut off. Thus, at about 55 mph and above, the ICE will drive the vehicle, and below about 55 mph, the Electric Motor (EM) will drive the vehicle.

The claims of Gardner involve a cruise mode condition. The cruise mode condition consists of a desirable vehicle speed and a desirable steadiness of vehicle speed and power. This is much different than the desirable highway speed of Ellers. Gardner allows the ICE to come into play at urban driving conditions, not just highway driving speed. An example of the Gardner condition would be urban driving at about 40 mph vehicle speed. Additionally, Gardner requires a steadiness of operation in order for the ICE to drive the vehicle. This will allow a relatively small ICE to be used. Ellers, on the other hand, never mentions

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steadiness of operation. Furthermore, by Ellers, one would be strongly inclined to use a fairly large ICE, since it will be used for all running above about 55 mph – though the ICE could be aided by the re-energized electric motor for a high rate of acceleration of the vehicle on the highway. It is quite unlikely the ICE of Ellers will operate with as high of efficiency as the Gardner ICE, and it is unlikely Ellers' ICE will yield as much reduction in vehicle emissions as Gardner's ICE.

Reading of Ellers strongly suggests charging of the electric-drive battery by the ICE only occurs when the battery, on 6-volts basis, has a voltage of less than 5.25 volts. This is a significant drawback of the Ellers system. This drawback is brought out by the statement in Ellers: "It has been found that if the vehicle of the present invention is driven approximately 30% of its mileage over 55 mph (on ICE) the batteries would never need charging from an outside source." Gardner overcomes this difficulty. That is, the ICE is used to charge the batteries when the vehicle is in cruise-off mode condition. Gardner proposes a significantly more robust electric-drive battery recharging system. It is unlikely Gardener's system will require external charging, even if the vehicle is driven primarily in the urban environment.

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13. Conclusion

In my opinion, the definitions discussed by the Examiner in 11 are not obvious to those of ordinary skill in the art of automotive power plant design. It is not obvious the highway speed condition of Ellers should be broadened to include urban driving speeds and steadiness of operation. It is not obvious the electric-drive battery charging method of Ellers, in which the battery is charged by the ICE only when the electric-drive battery falls below 5.25 volts, should be replaced by a system that charges the battery when the vehicle is operating below the cruise speed condition.

Further, affiant sayeth naught.

Dated: 12/9/99

Philip C. Malte

Philip C. Malte

STATE OF WASHINGTON)
) ss
COUNTY OF KING)

Subscribed and sworn to before me this 9th day of December, 1999.

Jean Alison Brouelette

Notary Public

My Commission Expires: 01-23-01

JEAN ALISON BROUELETTE
COMMISSION EXPIRES
NOTARY
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1-23-01
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